UTAH DEPARTMENT OF TRANSPORTATION

TECHNICAL BULLETIN MT-02.03
October 30, 2002

Nuclear Density Gauge Calibration

The purpose of this bulletin is to provide information for the task of gauge calibration and to reinforce UDOT's accepted method for gauge calibration.

PROPER APPLICATION

Calibration of a Troxler gauge ensures that the gauge yields accurate measurements of the material being measured for compaction control. There are two systems that require calibration and they are the density measurement system and the moisture measurement system.

The moisture calibration is obtained by taking twenty 1-minute counts. The average of the twenty counts is the moisture standard count. A drift range is also calculated and is placed on the gauge. This drift range is used each time a nuclear gauge is turned on, otherwise known as the standardization procedure. If the moisture and density counts during standardization procedure fall outside the drift range the gauge should be taken out of service and schedule it for calibration.

The UDOT standard calibration method for the density measurement system is called the Three-block Calibration. The types of density calibration blocks UDOT uses for calibration are: magnesium, magnesium/aluminum, limestone, aluminum and poly-mag. The process of density calibration is to take 4-minute density count readings at each of the rod positions for each calibration block. Collecting the necessary counts is quite labor intensive. The counts are recorded and input into the computer. The computer uses Newton's method for solving the calibration equation, basically at this point three equations of three unknowns are solved simultaneously. Each of the constants is a value that the gauge uses to yield accurate measurements of the material property under analysis. Over time these constants will change and as the radioactive material degenerates. The constants are then entered into the nuclear density gauge. A final check of the calibration is done on two different blocks and if everything checks the gauge is placed back in service.

OTHER INFORMATION

Annual calibration for each nuclear gauge is required. All UDOT nuclear gauges must be sent to Pam White, UDOT's nuclear calibration specialist, for annual calibrations. She is responsible for managing the calibration of all UDOT's nuclear gauges.

RELATED APPLICATIONS

To date the only approved method of calibration recognized by UDOT is calibration by the multiple (3) block method.

There is a composite block system on the market that can be used for verification purposes only. This composite block has some limitations that prohibit its use as a calibration method and they are: 1. The composite block relies on a previous calibration to be accurate. 2. The composite block system does not take into consideration the deterioration of the source.

FURTHER INFORMATION

For additional questions regarding nuclear density gauge calibration contact either:
Graham Starkie - Phone # 965-4202 or email Gstarkie@utah.gov, or
Pam White - Phone # 965-4291 or email PamWhite@utah.gov
Additional information can be found at Troxler's homepage: http://www.troxlerlabs.com/